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Polyamidoaminesas surface-modifiers and hydrogel scaffolds for cell culturing and tissue regeneration

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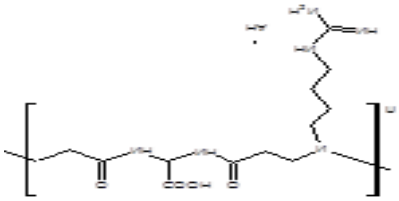
Polyamidoamines (PAAs) are tert-amine polymers prepared by polyaddition of prim- or sec-amines to bisacrylamides. The preparation method is simple and easily scaled up. The reaction is selective, allowing as monomers most amines and bisacrylamides. Consequently, PAAs are structurally versatile to a degree seldom encountered in stepwise polymerizations. PAAs are often water-soluble, biodegradable and, not withstanding their cationic nature, biocompatible. Cross linked PAAs are obviously insoluble, but in aqueous media form highly swellable hydrogels studied in the past as scaffolds for *in vitro* cell culturing of different cell lines. Recently, PAAs carrying guanidine side substituents were prepared by using guanidine-substituted amines, such as 4-aminobutylguanidine (agmatine), as monomers. Agmatine combined with 2,2-bisacrylamidoacetic acid gave a PAA called AGMA1 whose repeating unit mimics the Arginine-Gycine-Aspartic acid (RGD) peptide:



Linear AGMA1is non-toxic. Adsorbed onto culturing plates is excellent as cell adhesion and proliferation promoter for primary neural cells, equallingthe much more toxic polylysine. AGMA1 tubular conduits proved equally excellent as cross linked hydrogel scaffold for *in vivo* peripheral nerve regeneration. Used with the rat sciatic nerve cut model induced complete and morphologically sound regeneration, with satisfactory functional recovery without inflammation or neuroma. AGMA1 hydrogels responded favourably to MMT reinforcement, giving strong nanocomposites definitely warranting potential for osteoblastic differentiation of pre-osteoblastic cells MC3T3-E1. Finally, we developed new composite materials made of plasma-treated electrospun PLLA scaffolds imbedded inAGMA1 hydrogels. These materials were tested as scaffolds for pluripotent embrional stem cells culturing. The cells grew on them for seven days fully preserving pluripotency.

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